Space Weather Technical Forecast

Issued on Thursday, 18 November 2021 at 01:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active Electron Fluence expected days 1-3 (18th-20th). Chance of G1/ Minor Storms later on day 3 (20th) into day 4 (21st).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was very low with no significant flare activity observed. There are now two active sunspot regions on the visible disc, as AR2894 rotated round the west limb to the far side over the past 24 hours. Both AR2896 and AR2897 are small and simple Hsx/Alpha regions located in the western hemisphere. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind as measured by DSCOVR and ACE at L1 has been elevated to strong through the period but has begun to decrease over the past 6 hours from around 620 km/s to 540 km/s. The density has been average between 6 and 10 ppcc. The IMF has been mainly weak (<8 nT), with the north-south component, Bz, varying between +/- 5 nT. The phi angle was mostly negative (towards the Sun). Geomagnetic activity was mainly Quiet to Unsettled (Kp 2-3), but with an Active (Kp 4) interval from 17/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 remained at background levels. The high energy electron flux (greater than 2 MeV) was predominantly at background, below 100 pfu, but increased to moderate levels from around 17/1400 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), but has started to gradually increase, reaching 6.56e6 integrated pfu at 17/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Very Low, with a slight chance of C-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the current forecast. Waning effects of coronal hole 19 will see elevated or slightly elevated solar winds through Day 1 (18th), then decline to ambient levels on day 2 (19th). Later on day 3 (20th) into day 4 (21st) the solar wind is likely to become strong, as Earth connects to the high speed stream from coronal hole 20. Quiet to Unsettled geomagnetic activity is expected on day 1 (18th), with a chance of an isolated Active interval, before becoming predominantly Quiet on day 2 (19th). Later on day 3 (20th) into day 4 (21st) geomagnetic activity is likely to become Unsettled to Active with a chance of G1 / Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at background levels. The high energy electron flux (greater than 2 MeV) is expected to rise to persistently moderate or high levels on days 1-3 (18th-21st), in response to

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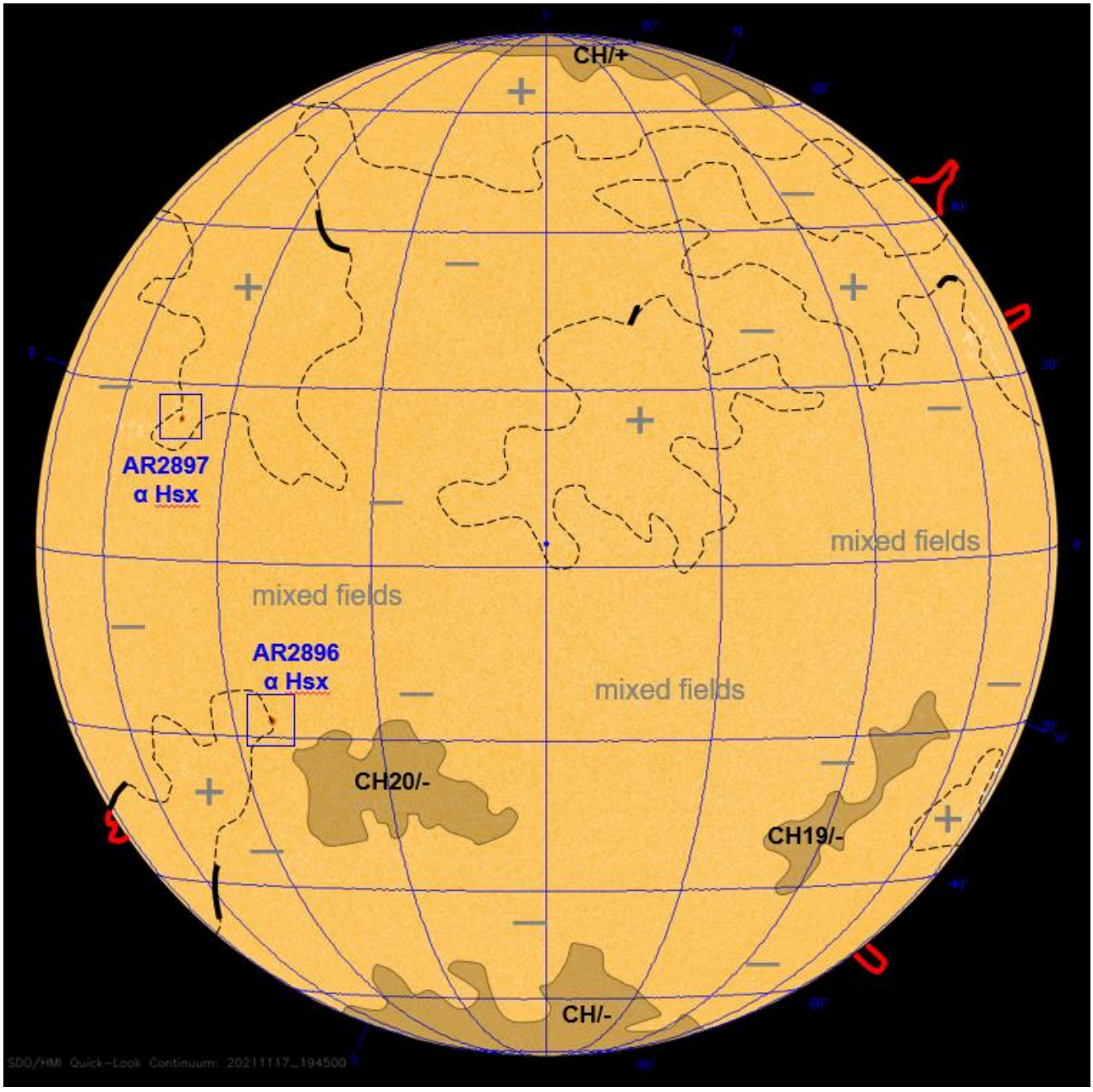
the recent solar wind enhancement. On day 4 (21st) electron flux is likely to become suppressed again as geomagnetic increases. The corresponding electron fluence is also expected to rise over the coming days and is expected to exceed the High (>1e8 integrated pfu) threshold by day 2 (19th), with a slight chance of exceeding the Very High (>1e9 integrated pfu) threshold, before dropping on day 4 (21st).

Figure 1. Solar Analysis Valid 17/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs currently in the forecast period.
Solar wind speeds are currently elevated due to connection with the high speed stream from Coronal Hole 19 (CH19/-). Solar winds are likely to remain elevated or slightly elevated on day 1 (18th), under the waning influence of the CH19/-, before returning to ambient levels during day 2 (19th). Later on day 3 (20th) into day 4 (21st) a further enhancement is expected in the solar wind, as Earth connects to the high speed stream from coronal hole 20 (CH20/-). It appears that STEREO-A, which is ~3 days ahead of Earth, connected to this feature during the second half of the 17th, with strong peak wind speeds in the region of 600-750 km/s, and thus a similar enhancement is likely at Earth.

Quiet to Unsettled geomagnetic activity is expected on day 1 (18th), with a chance of an isolated Active interval, before becoming predominantly Quiet on day 2 (19th). Later on day 3 (20th) into day 4 (21st) geomagnetic activity is likely to become Unsettled to Active with a chance of G1 / Minor Storm intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	20	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL.

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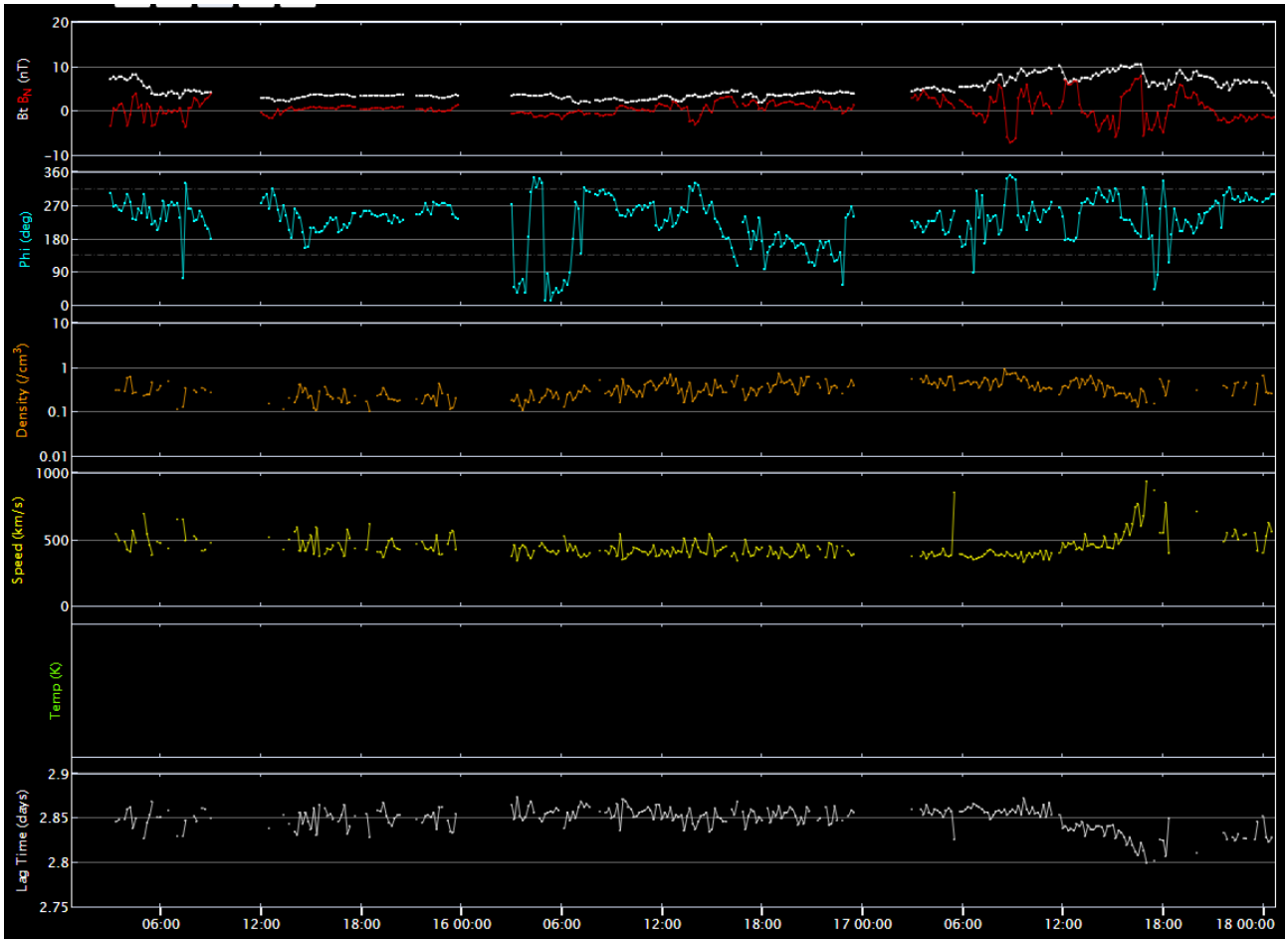
Figure 2: STEREO-A Mag and PLASTIC data for past 3 days, showing enhancement in solar wind from around 17/1400 UTC, possibly due to coronal hole 20 high speed stream.



Radio Blackouts - X-Ray Flares:

There are currently two active sunspot regions on the visible disc, since AR2894 transferred to the far side. Both AR2896 and AR2897 are small and simple Hsx/Alpha regions located, although AR2897 has shown some temporary pores in its trailing region. Solar activity is expected to be Very Low, with a slight chance for C-class flares. However, later in the forecast period some old spot regions may return from the far side which could increase the flare risk, but this will need assessed as they come into view.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	3	3	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as measured by GOES-16 is currently fluctuating between moderate and background levels. During day 1 it is likely to rise, in response to the recent elevated solar winds, with diurnal peaks reaching High (>1000 pfu) levels during days 1-3 (18th-20th). It is then likely to become suppressed again on day 4 (21st) as geomagnetic increases as Earth connects to CH20.
The corresponding electron fluence is therefore also expected to rise over the coming days and is expected to exceed the High (>1e8 integrated pfu) threshold by day 2 (19th), with a slight chance of exceeding the Very High (>1e9 integrated pfu) threshold. Electron fluence is likely to decline on day 4 (21st) due to CH20. REFM represents the increase in electron fluence over the coming days well, but some of its peaks values are probably too high.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	60	80	80	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	20	20	5

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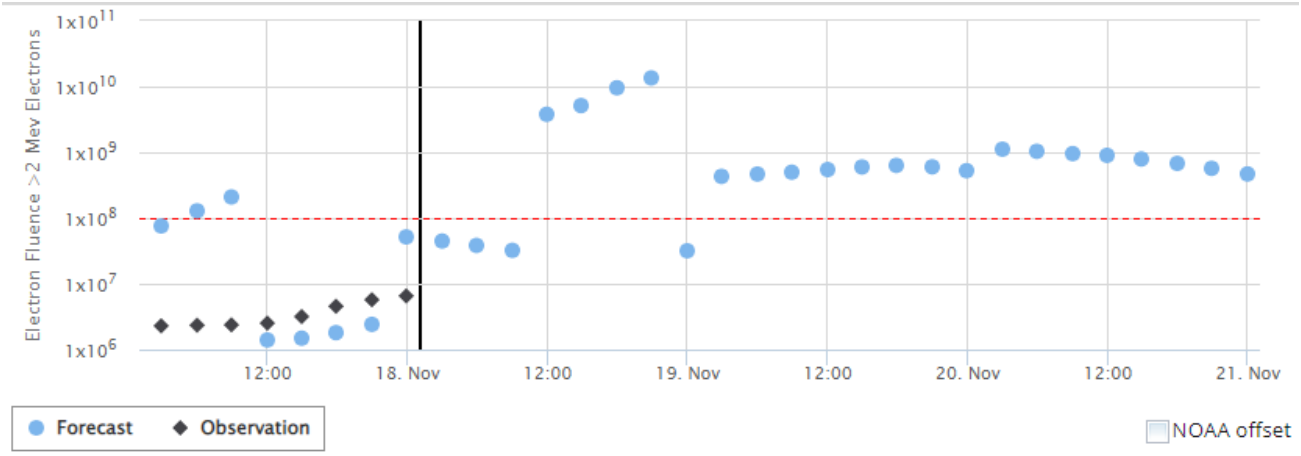
Figure 3: Observed GOES 16 electron fluence data and REFM data.



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